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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/501,616 | 05/25/2005 | John Gordon Rushbrooke | 920602-97103 | 2226 |

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| EXAMINER | |
|---|---|
| MIDKIFF, ANASTASIA | |
| ART UNIT | PAPER NUMBER |
| 2882 | |

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/501,616 | RUSHBROOKE ET AL. | |
| | Examiner | Art Unit | |
| | Anastasia Midkiff | 2882 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *21 February 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *67,68,73,76,79-83,86,87,92,93,96,97,107,108 and 111* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *67,68,73,76,79-83,86,87,92,93,96,97,107,108 and 111* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 93, 96, and 111 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent to Neale et al. (US 5,524,133).

With respect to Claim 93, Neale et al. teaches a material discrimination detector for use in an X-ray discrimination system for x-ray inspection using high energy X-rays (Abstract), including a front scintillation crystal (172) and a separate rear scintillation crystal (186) with a low-z converter (176) between said crystals (Figure 15).

The examiner notes that the limitation in Lines 4-5 of Claim 93, "wherein the front and rear crystals are cut from the same ingot of material" is directed to a product by process, wherein the process does not provide additional structure to the apparatus (*i.e.*, two scintillators of crystalline material need not be cut from the same ingot to have "matched performance"). (See MPEP 2113.)

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With respect to Claim 96, Neale et al. further teach ~~cesium~~ caesium [sic] iodide as the material used for detector scintillation crystals (Column 8, Lines 7-20).

With respect to Claim 111, Neale et al. teach a method of testing for the presence of a material whose effective Z is different depending on whether high or low energy X-rays are employed (Column 9, Lines 54-59), comprising the steps of inspecting an object under test using high energy X-rays of greater than 1 MeV (Column 8, Lines 30-33) and low energy X-rays of approximately 100 keV (Column 8, Line 1) and noting the effective Z of the constituents of the object at both energies (Column 2, Lines 10-18), comparing the values of Z obtained from the two tests for the constituents in the object (Column 2, Line19), and using a look-up table of known Z ratios for materials using the two X-ray energies to determine the identity of each constituent (Column 2, Lines 7-10 and 20-22).

Claim 93 is rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent to Maekawa et al. (US 6,570,160 B1).

With respect to Claim 93, Maekawa et al. teaches a material discrimination detector for use in an X-ray discrimination system for x-ray inspection using high energy X-rays (Abstract), including a front scintillation crystal (14) and a separate rear scintillation crystal (15) with a low-z converter (80) between said crystals (Figure 19).

The examiner notes that the limitation in Lines 4-5 of Claim 93, "wherein the front and rear crystals are cut from the same ingot of material" is directed to a product by process, wherein the process does not provide additional structure to the apparatus (*i.e.,* two scintillators of crystalline material need not be cut from the same ingot to have "matched performance"). (See MPEP 2113.)

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 67, 68, 73, 76, and 86 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent to Neale et al. (US 5,523,133) in view of U.S. Patent to Maekawa et al. (US 6,570,160 B1).

With respect to Claims 67-68, Neale et al. teach a material discrimination system (Title) including a high energy x-ray source (Column 10, Line 56), with a first detector component in the form of a thin scintillation crystal (Column 3, Lines 48-50) for registering the amount of X-ray energy deposited on the crystal wherein the amount of energy is essentially independent of the X-ray energy (Column 3, Lines 50-51), with a low Z converter located after this thin crystal (Column 3, Lines 52-54).

Neale et al. do not teach a thicker, one-piece downstream scintillation crystal, wherein the low-z converter is situated between the thin crystal and the thicker crystal and comprises aluminum.

Maekawa et al. teach a radiation detector (Figure 19) for detecting radiation of different energies (Column 1, Lines 7-13) with a first scintillation crystal (14) and a thicker, downstream scintillation crystal (15, Figures 18-19) sized to differentiate between the sensitivities of the scintillation crystals (Column 4, Lines 1-10), wherein an

aluminum low-z converter (80) is situated between the front and rear scintillation crystals (Figures 18-19) to allow improve the ability of a signal processing unit to discriminate between photon wavelengths distributed in each converter (Column 33, Lines 3-44).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the thicker crystal and placement of the converter of Maekawa et al. in the apparatus of Neale et al. to provide additional photon energy discrimination ability, as demonstrated by Maekawa et al.

With respect to Claims 73 and 76, Neale et al. further teach a high Z, high-density tungsten converter behind the low Z converter (Column 3, Lines 30-58).

With respect to Claim 86, Neale et al. teach an X-ray inspection/material discrimination system (Title) detector (Column 2, Lines 66-67) comprising a front thin crystal and a rear thick crystal sandwich (Column 3, Lines 44-58) wherein the latter is read out by a plurality of read out devices (Column 3, Lines 64-65) which sample at different depths in the beam direction (Column 3, Lines 39-43), and signals from the sampling devices are added (Column 3, Lines 59-67).

Neale et al. do not teach that the rear crystal is one-piece.

Maekawa et al. teach a radiation detector (Figure 19) for detecting radiation of different energies (Column 1, Lines 7-13) with a first scintillation crystal (14) and a thicker, downstream scintillation crystal (15, Figures 18-19) to differentiate between the sensitivities of the scintillation crystals (Column 4, Lines 1-10).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the thicker, one-piece crystal of Maekawa et al. with the high-z converter of Neale et al. to provide photon energy discrimination ability with a reduction in parts.

Claims 79, 80, 83, 87, and 92 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neale et al. and Maekawa et al., as applied to Claims 67 and 86 above, in view of U.S. Patent to DiFilippo (USP# 6,078,052).

With respect to Claims 79, 80, 83, and 87, Neale et al. and Maekawa et al. teach most of the elements of the invention, including adding the outputs of multiple photodiodes or fibers, but do not teach a pair of photodiodes or fibers connected to each scintillation crystal on opposite sides.

DiFilippo teaches a scintillation detector (Title) wherein the scintillation crystal (12) is read out at all points from opposite sides (Figure 2) by optical fibers on opposite side faces of said crystal (14, 16) adding each signal from each fiber within said bundle, *i.e.,* adding the signals of all fibers in the bundle of fibers at (14), to prevent loss of detectable photons from the crystal (Column 3, Lines 21-27).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the read out system of DiFilippo in the system of Neale et al., capturing all detectable photons and improving spatial resolution and energy resolution of the detector, as taught by DiFilippo (Column 3, Lines 21-27).

With respect to Claim 92, Neale et al. further teach that crystals are read out by optical plastic light guide fibers leading to a CCD (Column 6, Lines 19-23), with all read-outs added to produce a signal corresponding to the high energy x-ray component (Column 3, Lines 59-67).

Claims 81 and 82 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neale et al., and Maekawa et al., as applied to Claim 67 above, in view of U.S. Patent to Williams et al. (USP# 6,294,791).

With respect to Claims 81 and 82, Neale et al. and Maekawa et al. teach most of the necessary elements of the claimed invention, but they do not teach an absorber located at the rear of a detector assembly, wherein the absorber is formed of aluminum.

Williams et al. teach an X-ray material discrimination system (Abstract) wherein there is an absorber (40) in the form of an aluminum beam stop (Column 3, Lines 56-62), which provides shielding by reducing the intensity of photons that are back scattered from the walls of the system (Column 3 Lines 67, and Column 4 Lines 1-4).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the aluminum beam stop of Williams et al. in the system of Neale et al. and Maekawa et al. to provide shielding by reducing the intensity of photons that are back scattered from the walls of the system (Column 3 Lines 67, and Column 4 Lines 1-4), as taught by Williams et al.

Claim 97 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent to Grodzins et al. (USP# 6,151,381) in view of U.S. Patent Application Publication to Rivard (PGPUB# 2003/0204126).

With respect to Claim 97, Grodzins et al. teach a material discrimination system for X-ray inspection (Figure 1, and Column 2 Lines 37-40) of high energy X-rays which includes a Linac (50) for generating high-energy x-rays (Column 2, Lines 37-40), and a detector with crystals (26, 28), wherein a read-out system is synchronized to the Linac pulse with one read-out cycle for each pulse (Column 5 Lines 37-50, and Column 6 Lines 46-50).

Grodzins et al. do not teach that the read-out system also samples the output from detector crystals between each Linac pulse.

Rivard teaches a radiation read-out system for a pulsed radiation source which samples signals during "dead time" (non-pulse-time) to obtain a background noise count rate, and subtracts this background noise count rate from subsequent detector readings for samples examined (Paragraph 218).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the background calibration of Rivard between the Linac pulses of Grodzins et al. to remove background noise from the detector and improve accuracy of sample readings, as taught by Rivard (Paragraph 218).

Claims 107-108 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neale et al., and in view of U.S. Patent to Newman et al. (USP#5,420,441).

With respect to Claim 107, Neale et al. teach an X-ray material discrimination system for X-ray inspection (Title) using high energy X-rays (Column 4, Lines 38-40), which incorporates a Linac [linear accelerator] (10, and Column 10, Lines 55-56), in which the channels are normalized (Column 6, Lines 48-52), and calibration is performed for normalization by increasing the X-ray beam flux by known increments (Column 11, Lines 11-15).

Neale et al. do not teach a step wedge of absorbing material with increments of thickness chosen to yield fixed decrements of transmission between 90% and 10%.

Newman et al. teach a lead foil step wedge of varied thickness, which decreases X-ray transmission to a storage phosphor detector by fixed incremental percentages (Column 8, Lines 33-40) which normalizes detector photodiodes by calibration of signal-to-noise ratio of a photodiode detector exposed using calibration wedge signal value vs. average thickness (Column 8, Lines 47-67) and calibration of spatial resolution of photodiode detector exposed using calibration wedge (Column 9, Lines 7-20).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the step wedge of Newman et al. in the calibration of Neale et al. to calibrate the detectors accurately for noise and spatial resolution, providing more accurate measurements, as taught by Newman et al. (Column1 Lines 6-10, and Column 2 Lines 10-27).

With respect to Claim 108, it would have been an obvious matter of finding useful material, subject to availability, to choose PTFE as the step wedge material, since applicant has not disclosed that PTFE solves any stated problem or is for any particular

purpose and it appears that the invention would perform equally well with other x-ray attenuating materials.

***Response to Arguments***

Applicant's arguments with respect to prior art rejections of claims 67, 68, 73, 76, 79-82, 86, 87, 92-93, and 96 have been considered but are moot in view of the new ground(s) of rejection.

Applicant's arguments filed 21 February 2007, with respect to prior art rejections of Claims 83, 97, 107, and 111, have been fully considered but they are not persuasive.

With respect to Claim 83, the Applicant asserts that signals are not read out from opposite side faces in the crystal of DeFilippo. The examiner respectfully disagrees.

DeFilippo teaches two bundles of read-out fibers (14 and 16) wherein the two bundles are on opposite side faces of the crystal (Figure 2) and that signals from the readout fibers are added together (Column 3, Lines 21-27).

With respect to Claim 97, the Applicant asserts that the combination of Grodzins and Rivard does not suggest signals generated for pulses on which the Linac is not triggered resulting in a measure of background, noise, and crystal persistence. The examiner respectfully disagrees.

Grodzins teaches an alternating pulse trigger for a Linac with signals read out from each triggered pulse (Column 5 Lines 37-50, and Column 6 Lines 46-50), and Rivard teaches a calibration read out between triggering pulses of a Linac to obtain a

background noise count rate, and subtracts this background noise count rate from subsequent detector readings for samples examined (Paragraph 218). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use the background calibration of Rivard between the Linac pulses of Grodzins et al. to remove background noise from the detector and improve accuracy of sample readings, as taught by Rivard (Paragraph 218).

With respect to Claim 107, the Applicant asserts that Newman does not teach moving the step wedge across the x-ray beam, generating an average signal for each step, and thus does not teach the limitations of the claim in its combination with the Neale reference. The examiner respectfully disagrees.

Neale was not relied upon for the method of moving the step wedge and generating signals. Neale teaches calibration is performed for normalization by increasing the X-ray beam flux by known increments (Column 11, Lines 11-15). Newman was relied upon for using a step wedge of varied thickness, which decreases X-ray transmission to a storage phosphor detector by fixed incremental percentages (Column 8, Lines 33-40) to calibrate the detectors accurately for noise and spatial resolution, providing more accurate measurements by using materials of known attenuation. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use the step wedge of Newman et al. in the calibration of Neale et al. to calibrate the detectors accurately for noise and spatial resolution, providing more accurate measurements, as taught by Newman et al. (Column1 Lines 6-10, and Column 2 Lines 10-27).

With respect to Claim 111, the Applicant asserts that Neale does not teach x-ray energies of both 100 keV and greater than 1 MeV are used to determine the identity of constituent in the object under test. The examiner respectfully disagrees.

Neale teaches a dual-energy material discrimination system wherein two energies, one of 100 keV and one of 1-5 MeV, are used, to identify materials in the object under test (Column 8, Lines 1 and 30-38, and Figure 2).

Therefore, the prior art rejections of Claims 83, 97, 107, and 111 are maintained.

***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Patent documents to: Kampfer et al. (US 4,053,767), Macovski et al. (US 4,413,353 and 4,578,803), Barnes (US 5,138,167), Langenbrunner (US 5,514,870), Boone et al. (US 5,712,483), Moisan et al. (US 6,087,663), and Mario et al. (US 2003/0076924 A1) regarding dual scintillator x-ray material discrimination systems with a low-z converter between the scintillation crystals; to DeFilippo et al. (US 5,813,983) regarding dual scintillator x-ray material discrimination systems with scintillators of varied thickness; to Husseiny et al. (US 5,692,029) and Engdahl (US 5,753,917) regarding dual scintillator x-ray material discrimination systems in general; to Carver et al. (US 6,542,580 B1) regarding dual energy x-ray material discrimination systems utilizing 100 keV and greater than 100 keV energies; and to Lee (US 3,873,838) and

Chaney et al. (US 5,374,824) regarding reading out of signals from opposite side faces of a scintillating crystal or fiber bundle.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anastasia Midkiff whose telephone number is 571-272-5053. The examiner can normally be reached on M-F 7-4.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Glick can be reached on 571-272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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EDWARD J. GLICK
SUPERVISORY PATENT EXAMINER